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MATERIALITY AND MAGNITUDE:
EVENT STUDIES IN THE COURTROOM

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MATERIALITY AND MAGNITUDE: EVENT STUDIES IN THE COURTROOM

David Tabak and Frederick Dunbar[*]

I.   INTRODUCTION AND BACKGROUND

Since the Supreme Court's *Daubert* ruling,[1] there has been an increased scrutiny of expert testimony in the courtroom. This has given rise to the need for analyses that, to

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[1] *Daubert v. Merrill Dow Pharmaceuticals*, 509 U.S. 579.

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the extent possible, are testable, supported by published literature, have a known or potential rate of error, and follow procedures that derive from objective standards rather than from an expert's own potentially subjective opinions or beliefs.

An event study of a security's price, typically the measurement of a stock price's movement in response to a specific event or announcement, is an empirical technique that can be screened for admissibility with straightforward application of the Daubert factors. Testimony based on correctly done event studies has been admitted easily while testimony based on an infirm event study has recently been ruled inadmissible.[2]   Although commonly utilized in securities litigation, the use of event studies in other types of commercial litigation would be somewhat novel.[3]

We argue that a properly conducted event study is an underutilized tool in litigation outside the field of securities law, and that event studies are often applied in an inexact or unscientific manner within securities litigation.[4]   To examine the usefulness of event studies, this paper discusses how they can be used to measure the impact of two different types of events.   First, we look at revelations of securities fraud, where event studies are already commonly employed, though often using non-rigorous analysis.   Second, we examine the

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[2]   *In re Executive Telecard, Ltd. Securities Litigation*, 94 Civ. 7846(CLB), (S.D. New York 1997). See also *In re Seagate Technology II Securities Litigation*, C-89-2498(A)-VRW (N.D. Cal.), in which the court accepted some of defendants' event studies and dismissed certain claims on that basis, but ruled that defendants' other event studies were inadequate and denied their request for summary judgment with regard to those issues. The court also found plaintiffs' event studies lacking and therefore denied a cross-motion for summary judgment. Also, see *Goldkrantz v. Griffin* (SDNY, 1999), in which the court granted summary judgment based on plaintiffs' failure to contest defendants' event study analysis.

[3]   With regard to securities litigation, see, e.g., Janet C. Alexander, "The Value of Bad News," *UCLA Law Review*, Volume 41, Number 6, 1994, pp. 1421-1469; Daniel R. Fischel, "Use of Modern Finance Theory in Securities Fraud Cases Involving Actively Traded Securities," *The Business Lawyer*, Volume 38, November 1982, pp. 1-20; Jonathan R. Macey, Geoffrey P. Miller, Mark L. Mitchell, and Jeffry M. Netter, "Lessons from Financial Economics: Materiality, Reliance, and Extending the Reach of *Basic v. Levinson*," 77 *Virginia Law Review Association* 1017, (1991), pp. 1021-28; A. Craig MacKinlay, "Event Studies in Economics and Finance," *Journal of Economic Literature*, Volume 35, Number 1, March 1997, pp. 13-39; and Mark L. Mitchell and Jeffry M. Netter, "The Role of Financial Economics in Securities Fraud Cases: Applications at the Securities and Exchange Commission," *The Business Lawyer*, Volume 49, February 1994, pp. 545-590.

[4]   The use of an event study to measure the magnitude of an event is certainly not new. See, for example, Mark P. Kritzman, "What Practitioners Need to Know About Event Studies," *Financial Analysts Journal*, November-December 1994. ("Aside from tests of market efficiency, event studies are valuable in gauging the magnitude of an event's impact.") For a recent application see Jay Dial and Kevin J. Murphy, "Incentives, Downsizing, and Value Creation at General Dynamics," *Journal of Financial Economics*, March 1995.

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measurement of the effect of offending actions on plaintiff's future profits, an area in which the use of event studies is less common.

We also compare the event study to other methodologies for determining the importance and size of an outside event on a company, and examine the conditions under which properly conducted event studies provide more objective and accurate measurements of the effects of these events on the company. We begin by briefly describing the event study technique and the two items that stock price changes let us measure, materiality and magnitude, and their relevance to the determinations of liability and damages in a litigation context.

A. Overview of the Event Study Technique

Event studies of the type used in litigation rely on two well-accepted principles: first, the semi-strong version of the Efficient Market Hypothesis, which states that stock prices in an actively traded security reflect all publicly available information and respond quickly to new information;[5] and, second, the price of an efficiently traded stock is equal to the present discounted value of the future stream of free cash flow.[6] Consequently, the stock price impacts of an event can reveal the effects of the event on future cash flows if the following conditions are present:

1. The event is a well-defined news item.

2. The time that the news reaches the market is known.

3. There is no reason to believe that the market anticipated the news.

4. It is possible to isolate the effect of the news from market, industry, and other firm-specific factors simultaneously affecting the firm's stock price.

The procedure for performing an event study has several well-defined steps:

First, one estimates a predicted stock price return, or percentage change, from the day before the news reaches the market to the day the stock price assimilates the news. In doing

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[5] Richard A. Brealey and Stewart C. Myers, *Fundamentals of Corporate Finance*, New York: McGraw Hill, 1995, p. 306.

[6] Brealey and Myers, 1995, Chapter 4.

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this estimation, one uses a model that takes into account market and industry effects on stock price returns.

Next, the predicted return is subtracted from the actual return to compute what is called the abnormal return. If the abnormal return is calculated as the sum of individual abnormal returns over a number of periods (usually individual trading days), the difference between the actual and predicted returns summed over all these periods is called the cumulative abnormal return (or CAR).

Typically, the predicted return does not exactly equal the actual return even when no event has occurred. To determine whether the difference between the actual and the predicted return (the CAR) is just due to chance, the CAR is tested for statistical significance, as described in a later section of this paper.

The final step, if necessary, involves computing the relevant magnitude of the event. To do this, one calculates the change in stock price or capitalized value of the firm implied by the estimated CAR and thus attributable to the event in question.

Because of its wide acceptability, the existence of standards governing its operation, the known rate of error, and the ability to test hypotheses, the event study technique provides a good example of scientific evidence. Furthermore, these same factors mean that any particular event study can be screened under the *Daubert* guidelines to determine its admissability as the basis for expert testimony.

B. Materiality

One of the most important measurements that can be derived from an event study is that of the materiality of the event under consideration. While it is generally agreed that an event is material if it is important, this begs the question of how to measure importance. In the context of securities and corporate litigation, several measures have been considered. Mitchell and Netter, in their examination of the role of financial economics in litigation, note three such measures: reasonable investor, probability/magnitude, and market impact.[7] Unfortunately,

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[7] Arnold S. Jacobs, "Litigation and Practice Under Rule 10b-5," cited in Mitchell, Mark L. and Jeffry M. Netter, *op. cit.*

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these standards may be somewhat imprecise and decisions based on them are therefore rely on subjective determinations that vary from case to case. For example, how should a trier of fact determine what a reasonable investor would consider material? One could ask a long-time investor to serve as an expert on materiality, and while this does provide useful insight, the results are necessarily subjective and could vary from case to case.[8] Standardization over different cases could only come from a careful reading of the case law and would be followed by disputes about the similarity or difference between the case at bar and cited precedents. Instead, using the tools of financial economics, one can measure materiality as the probability that a stock price movement was due to chance and not due to the news about a particular event.[9] Materiality can thus be objectively quantified with an event study in a manner that can be compared across cases and events.

C. Magnitude

Event studies are also used to measure the size of a stock price movement as the basis for a damage calculation. For example, in cases of securities fraud, it is common to measure changes in the alleged inflation in a stock price by the movement in that stock price in the wake of a corrective disclosure, after controlling for market, industry, and other company-specific influences.[10] This is because inflation is removed from the stock price with the disclosure, and an event study measures the change in inflation in the stock at the time of the disclosure. Often, it is then assumed that this is the best estimate of the inflation per share if defendant had

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[8] Recognizing this problem, the court in *Feit v. Leasco Data Processing Equip. Corp.*, 332 F. Supp. 544, 586 (E.D.N.Y.1971), confronted with determining the materiality of an omission from a proxy statement, suggested drawing a scientific sample of investors to determine how they might have voted if the truth had been known. To our knowledge, this approach to materiality has never been attempted.

[9] Intuitively, if an event is material to investors, it should move stock prices, and if it is not material, it should not affect stock prices. By examining whether the stock price change is different from random movements that occur on days when there is no news, we can determine whether investors felt that the event under consideration was material. As an example, Mitchell and Netter state that "[t]he SEC recently began to use stock price evidence to show materiality in securities fraud cases, especially insider trading cases." Also, from the same paper, "Statistical tests of significance are useful both in establishing materiality and in calculating disgorgement. A finding that a stock return associated with the release of information is large enough that it is unlikely that the return occurred by chance is strong evidence that the information was important." Of course, this is only relevant for potentially large events. If it were announced that someone had stolen a $20 bill from a Sears cash register, we would not expect this to have any material effect on Sears' stock price.

[10] See, for examples, Alexander and MacKinlay, fn3 above.

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a duty to disclose the same information that was revealed in the corrective disclosure. As a result, an event study is a common method that serves as the basis for quantifying damages in security fraud cases.[11]

Consider a different litigation setting where plaintiff is a firm suing for lost profits due the company.[12] According to economic theory, there are circumstances in which damages can be measured by the change in the stock price caused by defendant's conduct multiplied by the number of shares outstanding.[13] This is true because stock prices are the market's estimate of the present value of future cash flows. Equivalently, stock prices are the market's estimate of a company's net liquid assets plus the present value of future profits from the operating assets.[14] Consequently, when there is an unexpected change in assets, liabilities, or expected future profits, this will show up as a change in the stock price. To the extent that defendant's actions giving rise to liability negatively impact the company's financial well being, the stock price will decline by the market's estimation of the present value of the harm that the company has suffered.

Though not a common approach in litigation, this proposition can be supported by caselaw. For example, consider a situation where a business files a suit claiming that it has been damaged because another party's illegal actions have reduced the company's value or

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[11] It is, however, not the only way to compute damages. Sometimes a fundamental analysis is appropriate. Also, the expected change in the stock price based on a sample of stock price changes in response to similar events may be used. Which approach is best will depend on circumstances relating to the allegations in the complaint and the reliability of the various types of estimates given the available data.

[12] The distinction between a firm and its shareholders is a legal artifact and ignores certain economic ambiguities. For example, in economics it is theoretically possible for the current shareholders to be the firm whereas under the law the firm is a distinct person. Presumably, this legal distinction is necessary to allow the firm to have access to the courts on behalf of the shareholders thereby reducing the inefficiencies that would occur if the shareholders themselves had to perform the legal duties of the firm.

[13] This is strictly true only if common equity is the sole source of financing. When the company has also issued debt and/or other forms of equity, lost profits would be measured by summing the changes in the market value of all of the outstanding financing sources (e.g., number of shares times the share price movement plus the number of bonds times the bond price movement). When the company does not face any serious threat of default on its senior obligations, the change in the market value of its common stock should serve as a good proxy for the change in the total capitalized value of the firm.

[14] The stock market's assessment would be on an after tax basis taking account of litigation expenses and contingent claims. The effects of these issues on damage assessment using stock prices are discussed in more detail in Section VII below.

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worth. Courts have supported the use of market value to determine the value of a company.[15] Thus, it naturally follows that the portion of the change in the enterprise's market value that can be attributed to the defendant, as determined by a careful event study, is a proper measure of the change in corporate value, i.e., damages, in this case.

II.   PERFORMING THE BASIC EVENT STUDY

A.   Identifying the Event

Many texts discuss how to perform an event study. While there are some differences in exposition, there is a uniform agreement in the literature on the necessary steps and general procedures to be followed. First, one must identify the event or events to be studied. In securities fraud cases, the events of interest usually include all the alleged disclosures of fraud and/or the dates when fraudulent statements were made. When one is trying to measure lost profits, the relevant dates would be those dates on which the public received information about the alleged wrongful act.

B.   The Event Window

Next, event windows must be established. Event windows are the periods over which stock price movements are calculated. Generally, these windows begin immediately before an announcement and conclude shortly thereafter. When it is unlikely that the news of an announcement was leaked beforehand, one typically would start the event window at the end of the trading day before the announcement was made; when there is a reasonable possibility that the information reached the market before a formal announcement, the event window may be extended back to include the potential leakage.[16] The end of the event window is somewhat

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[15] See Section VI below.

[16] It is also possible to look at intraday trading to get a tighter event window. This is especially useful if before the news announcement there was a large change in the stock price that one believes is due to other events and not to any leakage or anticipation of the announcement. Use of intraday prices, however, entails several difficulties. Among these are calculating movements of the market or industry index over the same time period and adjusting materiality tests to account for the non-standard event window. A suggested approach for determining the length of an intraday event window is in S. C. Hilmer and P. L. Yu,, "The Market Speed of Adjustment to New Information," *Journal of Financial Economics*, Dec. 1979. See also S. J. Chang and Son Nan Chen, "Stock Price Adjustment to Earnings and Dividend Surprises," *Quarterly Review of Economics and Business*, Spring 1989.

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more difficult to define. In securities fraud cases, many experts have adopted the convention of looking at one-day, two-day, or five-day periods following an announcement. The most recent academic pronouncement expresses support for the shorter, one-day or two-day window, though it recognizes that in practice longer windows are often used.[17] If a longer window is used, it is often cut short if there is another announcement within the normal time period.

As a general rule, there is a trade-off in extending the size of the event window. The longer the event window is, the more likely it is to incorporate all of the prior leakage and the market's ongoing adjustment to the news, but also the more likely it is to pick up other effects unrelated to the event under consideration. Determining the length of the event window is thus one of the most important considerations in performing an event study.[18]

C. Controlling for Market and Industry Effects

Once the event windows have been established, the next step is to calculate the relationship of the company's stock with the market. This relationship will later be used to remove market effects from the price movement observed in the event window.[19] These relationships are quantified by running a regression of the company's stock price on a market and/or industry index over a period of time labeled an estimation window.[20] Here, the analyst must make two additional decisions. First, over what estimation window should the regression be run? And, second, which market and/or industry indices will be used to control for outside influences on the company's stock price.

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[17] See MacKinlay, fn 3.

[18] As with other expert decisions, it is helpful when there is some rationale for the length of the event window chosen. For example, one can employ a standard period over different cases, cutting short the window when new information reaches the public. Alternatively, one can look at some other indicator of materiality, such as trading volume or the quantity of news coverage, to determine the period in which the market was reacting to the new information.

[19] While some crude event studies are performed without adjusting for market effects, the literature nearly uniformly argues that a market adjustment is desirable. Moreover, there is relevant case law, such as *In Re Executive Telecard Ltd. Securities Litigation*, which states that in measuring stock price declines, one must eliminate "that portion of the price decline that is the result of forces unrelated to the wrong."

[20] A regression is a statistical tool that is used to estimate the relationship between one or more variables (here, the market and/or industry index) and another variable (the stock price of a particular company). An early, but still highly useful, discussion is provided in Franklin M. Fisher, "Multiple Regression in Legal Proceedings," *Columbia Law Review*, May 1980.

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In regard to the first question, one would typically like to use an estimation window close to the event because the relationship between the company's stock and an index changes over time. Therefore, the closer the estimation window is to the event, the more relevant the estimated relationship will be. There are three general choices for the placement of an estimation window: before the event window, surrounding the event window, and after the event window. The most common choice is to place the estimation window before the event.[21] The estimation window can also be placed after the event windows or split to cover periods before and after the event window. When multiple events are studied, the estimation window may cover the periods around the event windows, including the period(s) between event windows. The estimation window is often placed at one of these locations rather than before the event window because of a lack of relevant prior trading history (for example, because the event window comes shortly after an IPO or change in regulatory environment).[22]

In addition to determining the placement of the estimation window, the analyst must also determine the length of that window. Again a tradeoff applies: the longer the estimation window is, the more data there will be, implying a more accurate regression. On the other hand, the farther the estimation window stretches from the event window, the less the estimated relationship between the stock price and the market index is likely to represent the underlying relationship during the event window.

A second decision the analyst must make is which market and/or industry indices to use to control for outside influences on the company's stock price. When deciding which indices to use, the analyst should consider both the source of the index and the relationship between movements of the company's stock price and the index during the estimation window.

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[21] In securities fraud cases, estimation windows are often placed before the beginning of the alleged class period, even if the only event measured is at the end of the period. This is likely done so that the estimation window would cover a "clean" period that could not have been tainted by any alleged stock price inflation. There is often no theoretical basis for doing so, because the concern about a "clean" period actually relates to the possibility of the estimation of the relationship between the stock and the index being contaminated by the effects of the event being studied. That is, one does not want any overlap between the estimation window and the event window. Depending on the nature of the alleged stock price manipulation, there may be no statistical basis for excluding prices during the period of alleged manipulation from the estimation window.

[22] Michael Salinger ("Value Event Studies," *Boston University School of Management Working Paper*, 1991) provides a theoretical discussion on whether to place the estimation window before or after the event window.

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A good index can be a standard index (say one developed by Standard & Poor's), one that was constructed based on comparable companies listed in analyst reports or public filings, or one based on selecting all companies that meet certain objective criteria (e.g., market capitalization within 10% of the pre-event market capitalization of the company being studied). On the other hand, an index is suspect when the choice of companies in the index is made by the expert without recourse to objective criteria.

The second consideration in selecting an index relates to how the company's stock price movements relate to those of the index during the estimation window. When the estimation regression is run, one of the statistics generated is the adjusted R-squared.[23] This statistic measures the strength of the relationship between the variable being explained (the company's stock price movements) and the combined set of independent variables (the market and industry indices) that are being used to do the explaining. The higher this statistic, the stronger the relationship. Another relevant statistic is the t-statistic associated with each independent variable; this statistic measures the strength of the individual independent variable's correlation with the company's stock price. The farther the t-statistic is from zero, the stronger the relationship. While one should not use either the adjusted R-squared or t-statistics as a blind measure for the comparison of the explanatory power of different indices, an expert should be prepared to provide these statistics.[24] Moreover, if the expert chooses one index with less statistical explanatory power than a second index, he or she should be prepared to defend this choice.[25]

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    However, see footnote 35 on his conclusion that such methodological choices are generally irrelevant for short event windows.

[23] The adjusted R-squared should not be confused with the [unadjusted] R-squared. The R-squared is a simple measurement of the explanatory power of the independent variables. The adjusted R-squared penalizes the use of additional independent variables to account for the possibility that any additional explanatory power that these variables bring to the overall regression is due solely to chance.

[24] Sometimes, the expert will use a multifactor model to predict the stock price. This is a model that has more than one index in it such as the S&P 500 and an industry index; see MacKinlay, *op. cit.* If the analyst tries a number of multifactor models and ultimately chooses a model with only one index, then the expert may have to support this decision with the relevant statistical test.

[25] There are various reasons for not simply choosing the index with the strongest statistical properties. One would be if it were known that there was a change in the operating characteristics or competitive environment facing members of one index between the estimation and event windows. Also, there are other considerations

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D. Estimating the Effects of the Event

The choice of the event window and indices used to predict the stock price over the estimation window provide the basic ingredients for the analytical steps of the event study. The estimated relationships from the regression during the estimation window are applied to control for market and industry movements in the event window. The predicted return is then compared to the actual return in the event window, with the difference representing the abnormal or excess return. This return, multiplied by the company stock price, provides an estimate of the per-share dollar effect of the event being studied.[26]

Finally, it should be noted that the abnormal return would include the effects of the event being studied as well as any other company-specific news or events (if any) that occur in the event window. Whenever possible, the effects of these events should be disentangled. The procedure for doing so would depend on the available data and the nature of the other event(s) in the window. For example, if the event coincided with an earnings announcement, the effects of the latter could be removed by estimating the stock price's response to earnings surprises and applying the measured relationship to the announcement within the event window. Though this would not perfectly remove the effects of the earnings announcement, the remaining abnormal return would be a much better estimate of the effect of the event for which the window was constructed. After removing the effects of these other events, materiality tests have to be adjusted to account for both the magnitudes of these events and the uncertainty surrounding the estimates of those magnitudes.

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involved in comparing statistics from different estimation windows, most notably that a good index from an estimation period near the event window may be preferable to an index with more explanatory power in an estimation period further from the event window.

[26] There is a question about whether to apply the abnormal return to the stock price at the beginning or end of the event window. This question essentially turns on whether the event occurs first, followed by market effects, or whether market effects come first, followed by the event. As an example, suppose that a stock price drops from $20 to $9 during an event window in which the predicted return was −10%. If we apply the predicted return first, the stock would have been expected to drop to $18, and then it fell by an additional $9 as a result of the event. Alternatively, one could say that the stock fell by $10 as a result of the event, reaching a level of $10, and then fell an additional 10% due to market forces, to reach its final level of $9. The difference is generally not important when market movements are small. In general, one would want to consider when in the event window the effects of the event were more likely to have been felt.

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III.   ARE EVENT STUDIES REALLY SCIENCE UNDER DAUBERT?

A. The *Daubert* Decision

In1993, the Supreme Court reviewed a standard on the admissibility of expert testimony that had been forth in *Frye v. United States (1923)*. The *Frye* standard was that an expert's methodology must be "generally accepted" in the scientific community to be admissible. In its 1993 ruling on *Daubert v. Merrill Dow Pharmaceuticals*, the Supreme Court expanded the admissibility standard set forth in *Frye* to allow potentially new though reliable techniques that had not yet achieved peer review. In its 1999 ruling on *Kumho Tire Co., Ltd., et al. v. Carmichael, et al.*, the Supreme Court clarified that the *Daubert* criteria apply to "all expert testimony."

The *Daubert* case was a product liability action in which the plaintiffs sought to establish a causal link between the ingestion of the prescription drug Bendectin during pregnancy and the subsequent delivery of children with birth defects. Consequently, the Court's decision focused on scientific, rather than economic testimony.

The Court found that the basic rule is that "all relevant evidence is admissible...."[27] According to the Court, relevant evidence must "assist the trier of fact to understand the evidence or determine a fact in issue...."[28]

The Supreme Court also limited the *Daubert* analysis to "scientific" knowledge, which it defines as based on the scientific method. The evidence must meet the same standards of all evidence by being "not only relevant, but reliable." In the scientific context, reliable evidence is "based upon scientific validity."[29] Crucially, however, the Sixth Circuit has expanded the *Daubert* framework beyond scientific testimony, to include technical and other specialized knowledge as well.[30]

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[27] Fed. R. Evid. 402, as cited in *State of Ohio, Ex rel., Betty Montgomery v. Louis Trauth Dairy, Inc.*, 925 F. Supp. 1247, 1251 (S.D. Ohio 1996).

[28] Fed. R. Evid. 702, as cited in *State of Ohio*, 925 F. Supp. at 1251.

[29] *Daubert*, 113 S. Ct. at 2795.

[30] *State of Ohio*, 925 F. Supp. at 1251.

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The Court admonished against proffering testimony that was based on "unsupported assertion" or "subjective belief." But rather than simply say what should not be done, the Court provided guidance by noting four factors that should be considered to assist in this inquiry:

1. whether the theory or technique can be tested;

2. whether the technique or theory has been subject to peer review and publication;

3. the known or potential rate of error and standards controlling the technique's operations; and

4. whether the theory or technique has been generally accepted by the scientific community.[31]

After the Supreme Court sent the case back to the Court of Appeals for the Ninth Circuit, that court suggested a fifth factor: whether the methodology was created solely for purposes of litigation.[32] The Sixth Circuit apparently also considers this factor important.[33]

B. Are Event Studies Objective?

We now take a moment to consider the effects of the choices discussed in the previous section to see if they would withstand being called "subjective belief" or "unsupported assertion" under *Daubert*. While it would be convenient if there were unanimously agreed upon guidelines covering all of these choices, if the calculation is to take into consideration the specifics of a particular case, some common sense must be added to the science.[34] This is because there are a number of considerations in determining the proper methodology for running an event study.

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[31] *Id.*

[32] *William Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 43 F. 3d 1311, 1317 (9th Cir. 1995).

[33] *Claude I. Smelser v. Norfolk Southern Railway Company, Norfolk and Western Railway Company* 105 F. 3d 299, 303 (6th Cir. 1997).

[34] Still, at least one court has ruled that in examining how events affected stock prices, "available techniques of proof such as econometric modeling are sufficiently demanding of internal consistency as to reduce the opportunity for such manipulation of data." *In re LTV Securities Litigation* (88 F.R.D. 134). Such a statement certainly could not be made about analyses where the analyst has the freedom to essentially make up one or more inputs to the calculation based on nothing more than a claim that those inputs are reasonable.

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The foregoing is not meant to imply that a standard procedure cannot be applied. In fact, it is often useful to do so when one is running a number of event studies for different firms (for example, if one wanted to look at how the average firm responded to a certain type of announcement). In that situation, it is common to establish a standard price reaction methodology both for ease of analysis and to prevent the possibility that the overall result is biased or even determined by choosing different methodologies for different events. When combining multiple event studies to determine how stock prices respond to events, it is not necessary to find a procedure that provides the best estimate for each firm or event individually; instead, with a large number of events being combined, errors in one event will, at least to some degree, cancel those in another.

When looking at the particular firm and events at issue in a lawsuit, however, it may be preferable to tailor the event study to the special circumstances at hand. As discussed above, in performing an event study there are at least three choices that feature prominently in the analyst's mind: (1) the time frame for the measurement of the price reaction; (2) the time frame for estimating the relationship between the stock and the market, both in terms of length of period and when the period should be relative to the event under consideration; and (3) which index or indices should be used to control for market and/or industry effects.

The effects of the different choices will naturally vary from case to case. Generally, though, the choice of index and estimation window is likely to have a relatively minor impact.[35] On the other hand, the choice of the time frame for measuring the price reaction (the event window) would be expected to lead to greater variability.

Even so, once these choices have been made, the analysis is performed objectively, in a manner that any other trained expert would be able to replicate. That is, if one specified an index, an estimation window, and an event window, any two experts would come up with the

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[35] In a seminal article, ("Measuring Security Price Performance," *Journal of Financial Economics*, 1980), Stephen J. Brown and Jerold B. Warner state that "a simple methodology based on the market model performs well under a wide variety of conditions." In discussing this and a later paper by the same authors, Michael Salinger, *op. cit.*, states that the previous authors' "results tended to be robust to the methodological alternatives." Salinger further states, "There is a schizophrenia in the event study literature between a very close attention to methodology and the view that for events of any importance, methodology is unlikely to matter a great deal. The latter view is probably quite appropriate when news is revealed over a brief, identifiable interval."

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same measurement for the price reaction.[36] This means that if one expert presents a result based on an event study, an opposing expert can check for errors in the underlying calculations. The opposing expert can also test what would happen if the first expert changed any of the assumptions. This allows for the determination of which assumptions, if any, are innocuous because changing them has no significant effect on the results. (E.g., adjusting for market movements with the S&P 500 or the Nasdaq Composite Index is likely to produce similar results if the indices moved similarly in the event window.) Conversely, the opposing expert can identify which assumptions, if any, drive the first expert's result and focus the debate on those points. (E.g., if the price reaction is large after two days but the price returns to its original level after five days, the debate can be focused on how long it took for all of the effects of the relevant event to be absorbed accurately by the market.)

In most cases, there are objective measures that can aid in evaluating the choices. For example, as discussed above, comparing the adjusted R-squared from one estimating regression to the next provides information that can help in deciding which better explains the stock price's movements.[37] In looking at the proper price reaction period, one could go with accepted standards in the literature or litigation or look at a proxy for materiality, such as the volume of a stock or number of news stories relating to the event, in deciding how to establish the window for measuring the price reaction.

C. Applying The *Daubert* Factors

The above considerations allow us to make straightforward answers to whether the event study technique satisfies the factors to be used in determining the admissibility of expert testimony as described by the Court.

1. Whether the theory or technique can be tested—the choices available to the analyst involving the index and estimation window are testable using statistics that are

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[36] To be entirely correct, one would also have to specify several other minor choices, such as whether to use logarithmic or percentage returns and whether returns are measured daily or over some other period of time.

[37] Of course, common sense must still be applied in interpreting these results. For instance, if a company moves from an environment characterized by a high degree of government regulation to one of low regulation, there would be reasons to potentially challenge the use of a regression from one period to account for market movements in the other.

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computed when the analyst performs a regression analysis of the firm's stock price return on the return of an index; the choice of event window may be tested using approaches mentioned above, although it may instead be based on convention (that is, the analyst can use a one- or two-day window supported by the literature rather than doing a separate analysis for each event study to determine *de novo* the length of the window most appropriate for the individual event under consideration) .

2. Whether the technique or theory has been subject to peer review and publication—by now there are hundreds of peer reviewed articles applying the event study methodology, including many that focus specifically on methodological considerations.

3. The known or potential rate of error and standards controlling the technique's operations—the error associated with either a test of materiality or the measurement of the size of the event is a statistic that can be estimated with each application; moreover, the academic literature provides guidance on proper application of the technique.

4. Whether the theory or technique has been generally accepted by the scientific community—the scale of publications alone shows that the technique has gained general acceptance.

IV.   DECIDING ON MATERIALITY

A. Standard for Materiality

In determining materiality, statistical analysis can provide information on the likelihood that the price movement was due solely to chance. Formally, a materiality test provides a statistical answer to the question: how likely is it that the observed stock price movement in the event window could have occurred if there were no event influencing stock prices in that window? For example, if an event is material at the 5% level, this means that there is only a 5% likelihood that the abnormal return (or the stock price movement once one controls for market, industry, and other effects) could have been caused by the stock's normal random price fluctuations. Alternatively, we can say that we are 95% confident that the abnormal return is greater than what would be expected based on the stock's normal random price fluctuations.

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It is not clear what level of statistical significance corresponds to a legal definition of materiality. As Mitchell and Netter point out, the 95% confidence level is commonly used, while the 90% and 99% levels are also options. But it is not clear how statistical confidence levels relate to burden of proof in civil (or criminal) litigation. What is clear, however, is that with an event study, the level of materiality can be quantified, compared across cases, and assessed using professional standards from the economics literature.

B. Price Reaction Methodologies

1. Simple Price Reaction

Occasionally, expert reports will contain a conclusion on materiality based on the observation that the stock price reacted to an event and, relying solely on the expert's background and judgment, this price reaction was material. Absent more, such an opinion would fail the Court's admonishment to avoid "unsupported assertion" and "subjective belief." Besides obviously not satisfying the factors laid down for scientific evidence (including testability, known rate of error, standards for operation of the technique and general acceptability) the approach fails to consider the other potential influences on the stock price over the time period the price was observed to be falling. This alone would make the proffered opinion run afoul of *Executive Telecard*.

2. Net-of-Market Price Reaction

A somewhat more sophisticated, and common, methodology designed to take account of other influences on price reactions is to simply measure so-called net-of-market movements. This is done, for example, by, first, computing the average price of a security over the five days before an event and the average price over the five days after the event. The percentage change in these two averages is then compared to the percentage change of a market or industry index over the same period of time.

This methodology has at least two flaws. First, this form of price reaction implicitly assumes that the stock moves one-for-one with the chosen index. There is, however, no reason not to test this assumption with, say, a regression analysis to measure the relationship between the security and the index. The regression would supply a beta, or a coefficient showing how

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much the stock moved with the index, and a t-statistic on that coefficient, showing the statistical significance of that relationship. If the beta is statistically different from one, it would be difficult to see why one would throw out the empirical results in favor of the generic alternative. [38]

A second problem with the net-of-market methodology is that it does not allow for the most accurate determination of materiality. Under a net-of-market analysis, a materiality determination can be made by looking at the standard deviation of five-day net-of-market price movements (and, again, there is no excuse for not doing so). However, because the index adjustment is flawed, the abnormal returns are incorrect, and the materiality test is not as powerful as it otherwise could be.[39] At best, one could look at the distribution of betas for a large sample of stocks and calculate the increase in the rate of error from assuming that the beta equals one. However, this is not specific to the case at hand and only further goes to show that the rate of error is higher than if the beta had been explicitly calculated via regression analysis.[40]

When used by itself, the net-of-market adjustment would appear to fail some of the *Daubert* criteria. First, a simple net-of-market calculation has no known rate of error (in part because the analyst never computes the standard deviation of the average five-day return). Second, its support in the academic literature is generally limited to studies that focus on many firms, where running multiple market model regressions may be cumbersome. Finally, because a net-of-market model provides no test for the goodness-of-fit of the index (i.e., an adjusted R-squared or any other residual analysis is never computed), the index choice is more subjective

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[38] The net-of-market methodology also assumes that the constant term from the regression, or alpha, equals zero. References to an assumed beta of one should be considered to include this second assumption as well. We do not independently criticize the assumption that alpha is set equal to zero over the event window. Given an accurate estimate of beta, it is possible for reasonable analysts to perform the analysis with different estimates of alpha than what would be produced from a market model regression. One assumption, for example, is to compute an estimate based on the formula given by the Capital Asset Pricing Model; this formula would produce a value of alpha equal to zero whenever beta equals one. In practice, different reasonable estimates of the value of alpha generally do not make a noticeable difference in the expert's findings.

[39] If betas are symmetrically distributed around one, the materiality test would be unbiased but not efficient. This means that (1) excessively positive and excessively negative returns would roughly balance over numerous observations; but (2) that other tests were more likely to give the correct answer on any one individual case.

[40] In addition to yielding a poor materiality test, the estimated magnitude of the price movement in the event window is also more prone to error.

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than when such a statistic is used to evaluate the appropriateness of different indices. None of the above is meant to say that net-of-market models are useless or necessarily wrong; rather, they are dominated by regression analysis and should not be used unless other choices add error or are infeasible. (For example, if a company goes public and then stops trading all within an extremely short time frame, the lack of trading data may make the regression results unreliable.)

C. Changing Levels of Materiality

A final issue pertaining to materiality is what to do when the cumulative price reaction moves in and out of materiality as time passes. For example, if a stock drops by a large amount on the day of an announcement, the one-day reaction may be significant. However, a rebound on the next day may cause the two-day price reaction to be not material, while another drop on the third day may cause the three-day price reaction to regain its status as a material event. In general, it would be necessary to look at why the level of materiality changes over the price reaction window. If there is new information being introduced to the market that is not relevant to the instant case, then the effects of this new information should be removed in considering the materiality of the event under examination. In addition, one would want to see whether the changes in materiality came from the market reevaluating the importance of the initial event or information, something that can often be deduced from contemporaneous news stories or analyst reports.

As a general matter, the potential for stock market overreaction is now generally accepted as a factor in stock market behavior, at least in the 1970s and 1980s.[41] Though there remains some dispute over long-term overreaction, short-term price reversal after unconditional price declines has been detected in large samples of stock prices. This means that if the price initially declines after an event and if, say on the second day, the price returns to a level that

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[41] See Werner F. M. DeBondt, "Stock Price Reversals and Overreaction to New Events: A Survey of Theory and Evidence," 1989; Rui M. C. Guimaraes, Brian G. Kingsman and Stephen J. Taylor, eds. A Reappraisal of the Efficiency of Financial Markets. Berlin: Springer-Verlag. Much of the evidence is from the research of Paul Zarowin including his 1989 article "Short-Run Market Overreaction: Size and Seasonality Effects." *The Journal of Portfolio Management*, Spring, pp. 26-29. See also M. Bremer and Richard Sweeney, 1987. "The Information Content of Extreme Daily Rates of Return." Working Paper, Claremont McKenna College later published in the *Journal of Finance*.

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makes the event not material with no intervening news event, then there is justification for assuming short-term overreaction. The analyst would be hard pressed to make a finding that the event was material under this fact pattern.

V.   MEASURING LOST PROFITS

This section examines how an event study compares to other methodologies for measuring lost profits.[42]

A.   Lost Profit Calculations Based on Projections

Lost profits are often calculated by measuring changes in future profit estimates using data from before and after some specific action by defendant which harmed the plaintiff. For example, suppose that before an allegedly tortious event occurred, analysts projected that Prospects, Ltd. would have profits of five million dollars in each of the next five years. Further suppose that following the event, analysts projected that Prospects' profits would be one million dollars for the next three years and two million dollars for the following two years. Prospects has therefore been harmed, in the analysts' view, by the present value of four million dollars for each of the next three years plus three million dollars for each of the two years after that. Prospects' harm would also include effects that would be measured by the changes in projections that could have been made for periods more than five years in the future.

Note that this form of measurement does not depend on the actual realization of profits. Instead, it concerns changes in the expectation of future profits at the time of an event. In that sense, it is quite similar to an event study, in which stock prices before and after the event are the market's projections of future profits or cash flows.

Thus, the principal question that arises here is which set of projections to use, those assumed by the market in setting stock prices, or some other set of projections from a different

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[42] For more detail on some of the alternative methods, see, for example, Carroll B. Foster, Robert R. Trout, and Patrick A. Gaughan, "Losses in Commercial Litigation." *Journal of Forensic Economics* 6(3), 1993, pp. 179-196. This paper discusses some of the means of measuring lost profits based on projections and accounting statements. Interestingly, while the authors say that the methodology they describe "is conceptually similar to the situation where a plaintiff suffered a loss of a passive investment, such as a securities fraud case," they do not appear to consider whether the event study methodologies of securities fraud cases could be applied to measuring lost profits in a commercial setting.

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source. In deciding this issue, one criterion is the degree of objectivity in the two measures. The event study is based primarily on market conditions, or on values set by investors only concerned with obtaining the proper value for their purchases and sales, and not by parties interested in the outcome of the litigation. Investors have incentives to set the price correctly because they put their money where their mouths are. If the market believes that a stock is underpriced relative to the company's value, investors will place orders to buy the stock, driving its price up; similarly, if the market consensus is that a company's stock is overpriced, sell orders will drive the stock price down.

In an examination of expected lost profits based on the change in analyst or expert projections surrounding the allegedly tortious act, the results will naturally depend on which projections are used. Often, there is a large range of projections for profits from the company and analysts. However, this is true only in the short term. If one goes out more than a few years, there are often no projections or only internal company projections. And at some point, there are generally not even company projections. Thus, for events that are likely to have a long-term impact on profits, projections often have to be created by the expert in the litigation. Even if the expert attempts to be completely objective, this often involves a large degree of relatively subjective guesswork. [43] Moreover, even when projections are available, the expert must decide which one or ones to use.

Finally, in working with projections, the expert must decide at what rate to discount future lost profits or what multiple to apply to some current or projected financial measure, such as earnings per share. It is not uncommon to see the same financial analyst give a range of multiples that yield projections where the largest number is several times the smallest, a result rarely seen in measuring the market capitalization of a company. Other times, an expert may choose to use an average multiple based on a peer group. This analysis unfortunately entails one of the same difficulties as choosing an index for a regression, namely, deciding which companies to use as comparables. However, unlike a regression, where an adjusted R-squared gives an indication of the goodness of fit, one typically does not attempt to measure the

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[43] For a series of simple examples on how the same data can lead to extreme variations in lost profits, see Robert L. Dunn, Recovery of Damages for Lost Profits, 1992, pages 459-470. ("The point made is that, depending on the approach taken, great variations in projections will result.")

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strength of the relationship between the comparables and the company being investigated. If the analyst is calculating a weighted average cost of capital in order to determine a discount rate, part of the process would typically involve calculating the expected return on equity, a process that involves a market model regression. [44] Thus, many of the criticisms that apply to event studies would actually also be applicable to analyses based on projections.

If done carefully, the use of analyst projections to calculate lost profits is likely to satisfy the *Daubert* criteria, though perhaps not as well as an event study would. In an event study, one uses stock prices, figures that are accepted by all to be what they represent: the market's current valuation of a company's equity. In looking at projections, the question arises as to which set of projections to use. If one uses projections from the same disinterested analysts both before and after the tortious event, there is likely to be little objection about subjectivity (provided, of course, that one does not select only those analysts who viewed the event as especially large or small). If the expert uses projections from one of the interested parties, such as the plaintiff company, or makes his or her own estimates of what projections should have been before and after the tortious event, then subjectivity becomes a serious concern.

B. Lost Profit Calculations Based on Future Events

Lost profits are also often calculated by comparing actual results to projections made at or immediately before the alleged business interference. This section compares the calculation of lost profits using this methodology to the calculation of lost profits through the use of an event study.

Let us return to the example of Prospects, Ltd., which was expected to have five million dollars in profits in each of the five years immediately following the tortious event. Suppose that its actual profits were one million dollars in the first year, and three million dollars in each of the next four years. Prospects' damage claim would then include four million dollars in lost profits from the first year and two million dollars in lost profits from each of the subsequent years. These values would then be expressed in present value terms, and/or adjusted for

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[44] See, for example, Brealey and Myers, *op. cit.*, at 162 on the calculation of the expected return to equity.

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prejudgment interest, until the time of judgment. In addition, the company would still have a claim for any lost profits occurring more than five years from the time of the wrong.

The most important difference between the methodologies is that an event study (or a comparison of changes in projections as discussed in the previous section) is an *ex ante* analysis while an examination of actual results is an *ex post* analysis. This means that an event study attempts to measure the *expected* lost profits based on information available at the time of the malfeasance, while an examination of future results attempts to measure the *actual* drop in profits over time as a result of that malfeasance.

The first question to address is which measure is appropriate. In answering this, we must practically be guided by any controlling legal definitions of damages, such as those effects occurring at the time of a breach of contract, etc. Assuming that either method is legally permissible, the next question should be what effects each rule will have on the current and future cases. The *ex ante* methodology will provide a better set of incentives: both to potential malfeasors, because their punishment will be more closely matched to their knowledge at the time of the event, and to victim firms, because they will still maintain the incentives to mitigate any losses after the event.[45] The *ex post* methodology, on the other hand, is more likely to compensate victims according to their loss.[46] The choice of which objective to follow is a long-standing issue and not one that will be decided in this paper.[47]

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[45] While there is still an incentive to mitigate damages using an *ex post* measure, because a failure to mitigate can be considered in the calculation of damages, that incentive is distorted by the chance that a trier of fact will err in determining whether the level of mitigation was correct. With the *ex ante* methodology, the plaintiff bears all of the costs and benefits of mitigation, and thus has the proper incentives to choose the optimal mitigation strategy.

[46] Note that if the victim receives punitive damages in addition to compensatory damages, this rationale loses most of its thrust.

[47] For a discussion of this issue, see Franklin Fisher and R. Craig Romaine, "Janis Joplin's Yearbook and the Theory of Damages," *Journal of Accounting, Auditing & Finance*, 1990; James M. Patell, Roman L. Weil, and Mark A. Wolfson, "Accumulating Damages in Litigation: The Roles of Uncertainty and Interest Rates," *Journal of Legal Studies*, June 1982; R.F. Lanzillotti and A.K. Esquibel, "Measuring Damages in Commercial Litigation: Present Value of Lost Opportunities," *Journal of Accounting, Auditing & Finance*, 1990; and William B. Tye, Stephen H. Kalos, and A. Lawrence Kolbe, "How to Value a Lost Opportunity: Defining and Measuring Damages from Market Foreclosure," *Research in Law and Economics*, 1995. All four articles argue that the *ex ante* methodology is appropriate, and give varying degrees of support to the *ex post* methodology. Interestingly, one of the difficulties that the authors find with the *ex ante* methodology is that computing the change in expectations of future profits can be difficult in many circumstances. This difficulty is reduced

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We now turn to the sources of bias in the *ex post* methodology. (Sources of bias in event studies were discussed in previous sections.) Examinations of actual results are distorted by the confounding influence of later events. When one looks out over several quarters or years, profits invariably do not only change because of the event in question. As time passes, there will be changes in the economy, in the industry, and for the firm in question for reasons unrelated to the bad act. One can try to remove these effects from the lost profit calculation, but this can be a difficult exercise. In practice, isolating the damages from these other factors is often subjective. If actual profits are not adjusted, then the expert is implicitly assuming that

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significantly for publicly traded firms when one takes advantage of the fact that the market computes these expectations and reports them in the form of stock prices.

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later changes in market and industry conditions do not bias the results. Though the analyst may be convinced of this view, it is a position that may be at issue with case law.[48] The attempt to control for later changes in market and industry conditions should be examined for accuracy and the aforementioned *Daubert* criteria. An additional difficulty occurs if profits are expected to be lower beyond the time of the damage calculation. In that case, the analyst must make an *ex ante* calculation of expected future lost profits. When this occurs, all of the disadvantages of an *ex ante* calculation are present in addition to the projection issues discussed above.

VI.   RECENT LITERATURE AND CASELAW

The question of whether experts can use the stock (and debt) market value of a firm to value the underlying asset has been answered affirmatively by both appraisers and the courts. In the legal context, the so-called stock and debt approach to valuation has been advocated primarily for railroad and utility properties, but in principle it could be applied to firms in other industries.[49] Indeed, a recent textbook on corporate valuation devotes an entire chapter to the approach without limitation to type of firm or industry.[50]

Adherents to the approach make the claim that "[w]here data to make possible a stock and debt valuation are available, it is best to go no further."[51] With regard to the objectivity of the approach: "[t]he stock and debt method avoids overreliance on the judgement or expectations of a single individual (the appraiser) about the future prospects of the firm, substituting instead the consensus view of many market participants—all of whom, as we have said, have a strong interest in making accurate forecasts."[52]

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[48] As previously noted, *In Re Executive Telecard Ltd. Securities Litigation* states that in measuring stock price declines, one must eliminate "that portion of the price decline that is the result of forces unrelated to the wrong." As a general principle, one would like any damage calculation to measure only the effects of the wrong and to not include any other effects.

[49] See, e.g., Richard R. Simonds, "Public Utility Valuation Methods: Theoretically Equivalent But Not Redundant," *Property Tax Journal*, September 1992, pp. 289-300.

[50] Bradford Cornell, <u>Corporate Valuation: Tools for Effective Appraisal and Decision Making</u>, Irwin Prof. Publishing, 1993.

[51] Steven H. Hanke and Stephen J. K. Walters, 1988. "Recent Controversies in the Valuation of Utility Properties." *Public Utilities Fortnightly*, (July 21) at 24.

[52] Op cit. at 23.

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The stock and debt approach to appraisal has been accepted by both regulatory bodies and courts.[53] A recent court decision, *Elmer E. Mills and Louis Susman v. The Electric Auto-Lite Company et al.*, 552 F.2d, used language that virtually mirrored the professional literature. The Court held that to determine the worth of a company, "when market value is available and reliable, other factors should not be utilized… Although criteria such as earnings and book value are an indication of actual worth, they are only secondary indicia. In a market economy, market value will always be the primary gauge of an enterprise's worth."

Further, another Court recognized the distinction between the projections made by analysts and those implicitly made by the market: "… self-interest concentrates the mind, and people who must back their beliefs with their purses are more likely to assess the value of the judgment accurately than are people who simply seek to make an argument. Astute investors survive in competition; those who do not understand the value of assets are pushed aside. There is no similar process of natural selection among expert witnesses and bankruptcy judges."[54]

It follows from these citations that a change in the worth of a company is well measured by the change in capitalization of the company. Such change in worth, of course, can come from the present discounted value of the future stream of cash flows lost by the actions of a defendant. As such, the appraisal and valuation methods that support determining the value of a company by using the market value of stock and debt would also support determining the value of a company before and after the wrongful act of a defendant. This change in valuation is what the event study method measures.

VII.   DO EVENT STUDIES ACCURATELY MEASURE LOSS TO THE CORPORATION?

We next ask whether the event study is a reliable measure of damages. This includes a discussion of the issue of whether the technique really measures the loss to the corporation instead of, for example, the loss to shareholders.

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[53] "Court Declines Review in Five Cases, Including Three Involving Rail Property," *BNA Washington Insider*, June 6, 1995.

[54] In *In Re Central Ice Cream Company*, 836 F. 2d 1068 (7th Cir. 1987) at 1072.

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A. Stock Market Anomalies

A violation of the efficient market hypothesis means that stock prices may not reflect fundamental values which, in turn, means that the prices do not equate to the present discounted value of future dividends. Over the years following the stock market crash of 1987 there developed an academic literature which found a variety of anomalies in stock price behavior and which, when taken as a whole, has probably lead economists to have less faith in the efficient market hypothesis than they had in the 1970s.[55]

This is not to say that it is time to overturn the presumption accorded the efficient market hypothesis in *Basic v. Levinson*. Rather, we should view the efficient market hypothesis as just that—a presumption that can be disproved for a particular security in a particular time frame. The same literature that has focused on stock market anomalies has also provided analysts with the tools to diagnose the patterns of a stock price to determine whether its behavior is anomalous.

Although it is not the purpose of this paper to review either the stock market efficiency literature or the adjustments to the event study technique that might be called for if an anomaly exists, we mention a few issues that might arise that could affect the event analysis.[56]

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[55] Recent financial press commentaries on the volatility and high values of internet stocks are another event, which should lead to investigation of stock market anomalies.

[56] We omit here mention of stock price overreaction, which was discussed above in Section IV.

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1. Volatility

Well before Black Monday and the behavior of the stock market in the late 1990s, stock market volatility had been studied by financial economists.[57] The principal finding was that the volatility of stock prices may be greater than is justified by the variance of dividends. This means that there is no guarantee that stock prices will reflect fundamental value. This being said, these findings by themselves did not lead to professional rejection of the efficient market hypothesis—it was still treated as a presumption for any individual stock or stock market index.

By itself, volatility does not mean that the event study technique is worse than other methods of valuation. The reason for this is that it can be shown that virtually any asset returning a cash flow is likely to be volatile. For example, Paul Samuelson has shown that stock prices following what appears to be a random walk could be based on fundamental values, and, in a later article, that the price of land could be a stochastic process much as stock prices appear to be.[58] In both cases the source of the variation in prices is similar: for stock prices, dividends are a stochastic process because earnings themselves contain a stochastic component; for land prices, rents may also contain a stochastic component. This means, of course, that lost profits (damages) to the underlying asset will themselves be volatile. We should not be surprised, then, that event studies (measuring, as they do, the presented discounted value of the lost profits) have some statistical error associated with them though they are generally unbiased. As mentioned above, the dimensions of this error are understood with the test statistics that are typically computed when performing an event study.

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[57] For a review see Stephen F. LeRoy, 1989, "Efficient Capital Markets and Martingales." *Journal of Economic Literature*, XXVII pp. 1583-1621.

[58] Paul A. Samuelson, 1973. "Proof that Properly Discounted Present Values of Assets Vibrate Randomly," *The Bell Journal of Economics and Management Science*, Vol. 4, No. 2, pp. 369-374. And 1986. "Stochastic Land Valuation: Total Return as Martingale Implying Price Changes a Negatively Correlated Walk." Paul A. Samuelson's Collected Scientific Papers, Vol. 5, Cambridge: MIT Press.

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2. Speculative Bubbles

In light of the behavior of both the market and individual stocks since 1987, there has grown theoretical literature to show how speculative bubbles can form.[59] These theories show that in speculative markets where there are both informed and uninformed traders, it may be rational for the informed traders to follow the uninformed in a price trend away from fundamental value. If the theory is true, there is no mechanism that, in the short term, causes stock prices to equal the value of their underlying assets. Such an overpriced stock has the unfortunate tendency to crash when the bubble is burst. The bursting of the bubble can occur at the same time as, indeed be precipitated by, the event being analyzed to compute damages. Consequently, it is unlikely the price drop unadjusted for the speculative bubble is an accurate measure of damages. The effect of this condition has been noted in the legal literature with reference to shareholder class actions.[60] Fortunately, there are diagnostics that can be used to determine if there appears to be a speculative bubble and, if so, other techniques are available to measure the lost profits.[61]

B. Bias from Litigation Expectations

One problem particular to event studies is that they tend to be biased toward finding a price drop that is too small because of the expectation of a possible recovery through the legal system. To see this, suppose a company lost a million dollars in future profits and was expected to sue and recover the million dollars, but at the expense of three hundred thousand dollars of legal fees. Then the price reaction observed in the market would only reflect the three hundred thousand dollar net loss. If this were successfully used as the basis for a damage calculation at trial, the company would effectively be reimbursed for the three hundred thousand dollars of legal fees but not for its actual loss of a million dollars in future profits. At the extreme, if the market expected the company to recover lost profits plus punitive damages,

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[59] See, for example, J. Bradford DeLong, Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann, 1990, "Positive Feedback Investment Strategies and Destabilizing Rational Speculation," *Journal of Finance,* Vol. 45, No. 2, pp. 379-395.

[60] Baruch Lev and Meiring Devilliers, "Stock Price Crashes and 10b-5 Damages: A Legal, Economic, and Policy Analysis," *Stan. L. Rev.,* November 1994.

[61] See above at 35.

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or treble damages, its stock price could even go up as a result of the malfeasance. Consequently, care is needed in interpreting the event study results; if the expected success of litigation is not trivial, there may be a large source of bias from this exercise. Still, because this bias serves to make price reactions show a smaller drop than that due to the defendant's act alone, an event study can still serve to show the minimum damage caused by that act.

C. Whose Loss Does an Event Study Measure?

One of the potential objections one may make to an event study is that it is measuring the wrong damages. Because an event study looks at the value of a corporation's shares, some may argue that one is measuring the loss suffered by shareholders and not by the corporation itself. This leads to the question of whether the event study is measuring the proper damages for use in corporate litigation.

The first answer is that this is a fair criticism of any measure of damage to a corporation. Suppose that Prospects' factory burns down in an apparently accidental fire on February 1, and that Prospects has no insurance to cover the loss. Further suppose that on March 1 it is suddenly revealed that the fire was not an accident, but was set by agents of a competitor, Ruthless Comp. Lastly, suppose that on March 1, Prospects sues Ruthless and everyone believes that it will recover the cost of rebuilding the factory plus any lost profits, however measured, as a result of the arson. We now ask: who wins and who loses?

In theory, if the damage payment is truly comprehensive, covering all manner of costs and legal fees, loss of competitive position, and so forth, and assuming no punitive damages are awarded, Prospects will be left exactly as well off as if there had been no fire. On March 1, its stock price would therefore recover to where it was on February 1, once one adjusts for market and other forces in the interim. Shareholders on February 1 who held through March 1 have seen a temporary drop in the value of their holdings but are unaffected at the end of the day. February 1 shareholders who sold before March 1 are worse off, because they sold their shares at a time when the price was unduly low. Conversely, investors who purchased between February 1 and March 1 benefit when their shares of Prospects appreciate in value on March 1. But note that this is true no matter how the damages to Prospects are measured, whether it is by the change in its share price or a discounted cash flow model of lost profits. Simply put, under

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the current legal system, investors who hold shares at the time of a bad act are damaged, while those who hold at the time of an unexpected recovery are benefited.[62] As such, because the change in stock price is simply a *measure* of the damage to Prospects, in the same way that a discounted valuation of lost profits is such a measure, concerns about winners and losers are not specific to the event study methodology.

D. Do Event Studies Capture All Components of A Loss?

Another argument against event studies is that by focusing on a small period of time, an event study does not provide a complete characterization of the effects of a wrongful act. To answer this, let's create an example where the case at bar involves some defamatory statements made by Ruthless against Prospects. Also, suppose that Prospects' stock price falls at the time that the statements were made. One could then ask whether changes in the public's views of the credibility of those statements shouldn't change the damage estimate from the libel. This possibility can be addressed in an event study by looking for changes in the perception of the libelous statements and measuring the effects that those changes in perceptions had on the stock price. For example, if there were a public retraction by Ruthless, one would want to offset the drop in Prospects' stock price in the event window corresponding to the original libel by the rebound, if any, in an event window corresponding to the retraction.

Again, however, this criticism does not apply solely to event studies. Suppose that an expert was measuring damages by looking at the decline in expected future income. Suppose further that the original libel caused a permanent 30% drop in Prospects' sales, perhaps because consumers were misled into believing that Prospects was marketing an unsafe product. If the retraction caused sales to rebound to within 10% of their previous level, this information would also have to be incorporated into measures of discounted lost cash flows.[63] Therefore, to the extent that new information affects continuing results, *any* measure of lost profits that does not

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[62] In some ways this is clearly unfair, as there has been a transfer of wealth from one set of shareholders to another as a result of an illegal act in which neither group knowingly participated. An alternative view is that when investors buy and sell shares, they are trading in the company's fortunes, including unexpected gains and losses from legal actions and certain illegal acts affecting the company's value.

[63] One advantage of event studies here is that if the changes in the perception of the libel occur at discrete times, these effects can be captured by using readily available stock market data. Directly measuring the changes in expected income at various points in time would require a large set of contemporaneous projections.

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purport to measure expected lost profits solely at the time of the original bad act must take this new information into account.

E. Tax Effects

The discounted cash flows measured by stock prices reflect free cash flow available to stockholders that, of course, are after tax. This creates the need for an adjustment to the event study measure of damages. Because damage awards are usually taxable, the convention has arisen that lost profit damages are awarded on a pre-tax basis. Fortunately, the adjustment to the event study magnitude to remove tax effects is rather simple; in most instances, it can be accomplished by dividing event study result by one minus the marginal income tax rate of the corporation.

VIII. CONCLUSION

We have seen that event studies can be useful in quantifying damages in cases ranging from securities fraud to other commercial litigation requiring the calculation of lost profits. In some areas, such as securities fraud, stock price reactions are already a standard method for quantifying damages. In such cases, the overarching question is how to perform the most accurate price reaction. This entails developing a model that accounts for market and industry effects. It also entails explicitly testing for the materiality of stock price movements. When this is done, we have a damage calculation that is based on economic literature and, given the results of the materiality test, has a known rate of error. In this manner, one can perform a damage calculation that meets the *Daubert* criteria for admission as expert testimony. A failure to perform these analyses when possible would mean that the analysis is not in accordance with the literature and has an unknown rate of error.[64]

In comparison to many other methods of calculating lost profits, the measurement of stock price reactions has the benefit of being based on numbers which, being determined by the collective decisions of all investors in the market, are both objective and present a consensus,

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[64]   While the actual rate of error is not known without the materiality test, if the stock is simply assumed by the expert to move one-for-one with the market, we can be sure that the rate of error is higher than if the relationship between market and stock movements used in the damage calculation is based on statistical analysis.

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rather than an idiosyncratic, viewpoint. While the measurement of stock price reactions will inevitably incorporate some degree of choice on the part of the analyst, the degree of subjectivity in these choices is usually quite low.[65] This is in stark contrast to the situation where an analyst has to choose some set of projections and then decide how to discount those projections back in time, to say nothing of the subjectivity involved in making new projections for the purposes of litigation.

When using stock price movements to measure lost profits, one is employing a methodology that is supported by the academic literature, is completely replicable, has a measurable rate of error, and uses a minimal number of variables. By contrast, an analyst creating projections of future profits is engaging in a process that may not be replicable by others; while other experts can create their own projections, there is often no reason to believe that they would match those of the original analyst. When several independent sources of profits are available, a study of lost profits using projections requires deciding which projection(s) to use and how to discount the cash flows envisioned in those projections.

None of the foregoing discussion is meant to say that other analyses are not useful, or even necessary at times. When a company is not publicly traded, there would be no stock price data that one can use for an event study, and other methodologies often have to be employed.[66] In addition, other assumptions underlying the appropriateness of the technique, such as the efficient market hypothesis, may not be valid in any individual application requiring either adjustments to the results or abandonment of the method altogether.

Moreover, an event study and another methodology such as a discounted cash flow analysis can be used in conjunction as a test of the robustness of the damage calculation. If the two yield similar results, one should feel more confident in the final figure than if only one methodology were used. If the results differ materially, then the expert should examine

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[65] The general attitude toward event studies may be best summed up by Glenn V. Henderson, Jr., "Problems and Solutions in Conducting Event Studies," *Journal of Risk and Insurance.* "The event study is a classic design. Classic designs are simple and elegant, and above all else, functional. The event study has become a classic because it works. It can be used under less than perfect conditions and still produce reliable results."

[66] In a case where a private company went through with an initial public offering after suffering some harm, data on the actual offering price can be compared to a previously expected offering price to perform a basic event study. Appropriate market and industry adjustments to the expected offering price can be made based upon the stock's post-offering behavior.

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whether one or both studies is in error by considering the reliability of the data underlying each, the uncertainty surrounding any assumptions made in each analysis, and sources of error such as those discussed in this paper. If both methodologies still seem reasonable, the expert can use the two results to establish a likely range for alleged damages.

The most important reason to consider the use of an event study is that it is likely to provide a highly objective methodology for calculating the magnitude of damages and the materiality of the event that may have caused damages. In general, other methodologies for calculating damages do not provide a measure of materiality, other than the simple observation that calculated damages are large, small, or zero. By using the statistical tools that are the basis for event studies, an expert can provide not only a measure of damages that is based on objective data and calculations, but also a statistically accepted means of testing the materiality of this measurement.

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